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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/448,856	11/23/1999	ASHRAF W. LOTFI	LOTFI-22-2	5530

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EXAMINER

NADAV, ORI

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 11/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/448,856

Applicant(s)

LOTFI ET AL.

Examiner

ori nadav

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 44-47 and 49-54 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 44-47 and 49-54 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 44 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no support in the specification for a semiconductor device comprising a SiC tub located within a trench, and a CMOS device having a tub comprising a material different from the silicon carbide tub, as recited in claim 44.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 44-47, 49-51 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki (4,896,194) in view of Brown (5,672,889).

Regarding claims 44-45, Suzuki teaches in figure 2b and related text a lateral MOSFET including a GaAs tub 31 (column 3, line 31) located within or contacting a conductive silicon substrate 32 including a material different from the GaAs tub, a gate 36 formed on the GaAs tub and source and drain regions located in the GaAs tub, and laterally offset from the gate, and CMOS device 39, 40 formed on the conductive substrate and having a tub comprising the material, wherein the breakdown voltage of SiC layer is greater than that of a silicon.

Suzuki does not teach a SIC tub within a trench.

Brown teaches a MOSFET formed in a SIC tub, and the advantages of forming a power MOSFET in a SIC material instead of a GaAs material. Brown teaches that SIC has a high field saturation velocity which is three times larger than that of GaAs, a high intrinsic critical breakdown field which is ten times higher than that of GaAs and a high thermal conductivity which is ten times higher than that of GaAs (column 1, lines 20-27).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the MOSFET of Suzuki in a SiC material within a trench, instead of forming the MOSFET in a GaAs material in order to improve the device characteristics by improving the speed, breakdown voltage and the thermal conductivity of the device and in order to improve the control over the size of the tub, respectively.

Regarding the process limitations of forming a SiC tub in a trench, these would not carry patentable weight in this claim drawn to a structure, because distinct structure is not necessarily produced. Note that a "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that the applicant has the burden of proof in such cases, as the above case law makes clear.

Regarding claim 46, it is known in the art that a SiC has a breakdown voltage of 10 volts, and Si has a breakdown voltage of about 3 and 5 volts

Regarding claim 47, Suzuki and Brown teach a power device. Suzuki and Brown do not teach using the MOSFET and the CMOS device as a power switch for a power converter. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the MOSFET and the CMOS device of Suzuki and Brown as a power switch for a power converter in order to use the device in an application which requires a power switch and a power

converter. Note that a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963).

Regarding claim 49, Suzuki and Brown teach a tub located over the substrate.

Regarding claims 50-51, Suzuki and Brown teach a substrate and source and drain regions doped with a p or n type dopant.

Regarding claim 53, Suzuki and Brown do not teach a 3C SiC. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a 3C SiC in Suzuki and Brown's device, because 3C SiC is a conventional SiC, of which official notice is taken.

2. Claims 52 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki and Brown as applied to claim 44 above, and further in view of Takasu (5,326,991).

Regarding claims 52 and 54, Suzuki and Brown teach substantially the entire claimed structure, as applied to claim 44 above, except forming the device on an

SOI substrate. Takasu teaches in figure 7 forming the device on an SOI substrate.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form Suzuki and Brown's device on an SOI substrate in order to improve the electrical isolation of the device.

### ***Response to Arguments***

Applicant argues that figure 2F provides support for the claimed limitation of a SiC tub located within a trench

Although figure 2F provides support for a SiC tub located within a trench, there is no support in the specification for a semiconductor device comprising a SiC tub located within a trench, and a CMOS device having a tub comprising a material different from the silicon carbide tub and located on the substrate, as recited in claim 44. Figure 2F describes a SiC tub located within a trench in a SiC substrate without having a CMOS device having a tub. The device described in the embodiment of figure 3 includes a SiC tub located above the substrate, and a CMOS device located in a silicon substrate. Forming a device comprising a SiC tub located within a trench (i.e. the tub must be located inside a substrate of an undisclosed material), and a CMOS device on the substrate and having a tub comprising a material different from the silicon carbide tub, as recited in claim 44, is not described in the specification.

Regarding the rejection of claim 48 for the reasons described in claim 44 ("as recited in claim 44"), claim 48 was previously cancelled, and the citation of claim "48" in the first line of the rejection instead of claim "44" was due to a typographical error.

Applicant argues that it is not obvious for an artisan to form the GaAs layer 31 in a trench in substrate 32 of Suzuki.

The device of figure 2b of Suzuki is structurally identical to device 307 of figure 3B of the present invention. Applicant argues that device 307 in figure 3B, which is located above the substrate, may be formed in a trench by one skilled in the art. Therefore, in a similar manner, since it is obvious for one skilled in the art to form device 307 of applicant in trench, then it would have also been obvious to an artisan to form GaAs layer 31 of Suzuki's device in a trench, as claimed.

Applicant argues that there is no motivation to combine the vertical device of Brown with that of Suzuki.

Brown is cited to teach an artisan the advantages of forming a power MOSFET in a SiC material instead of a GaAs material. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the MOSFET of Suzuki in a SiC material within a trench, as claimed.



***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

**Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.**

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Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(703) 308-8138**. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**

A handwritten signature in black ink, appearing to read 'Ori Nadav', written in a cursive style.

O.N.  
November 1, 2003

ORI NADAV  
PATENT EXAMINER  
TECHNOLOGY CENTER 2800